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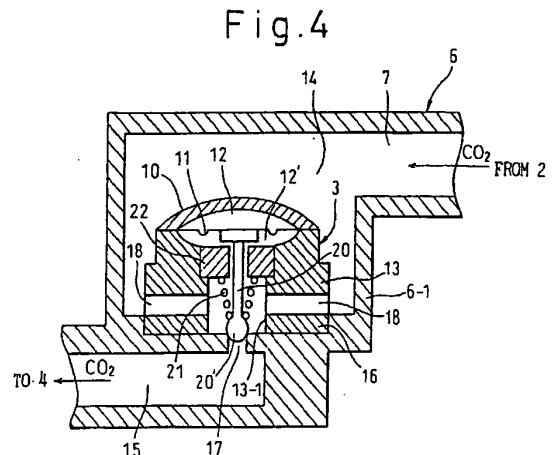
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(54) Refrigerating system with pressure control valve

(57) A refrigerating system of vapor compression type operating at a super critical area, while obtaining an increased efficiency. The refrigerating system includes a pressure control means (3) for controlling the temperature and the pressure at the outlet of a heat emitter (2). The pressure control valve (3) responds to a pressure difference between the inlet pressure of the refrigerant to the pressure control valve and the pressure in an outwardly sealed chamber (12) in which the refrigerant is filled such that, with respect to the volume of the chamber (12) under closed condition of the pressure control valve, a density of the refrigerant is in a range between a density of a saturated liquid at a temperature of 0°C and a density at the critical point of the refrigerant. As a result, the pressure and the temperature at the outlet of the heat emitter (2) is controlled substantially along the optimum control line η_{\max} , resulting in an effective execution of a refrigerating cycle at the critical area.



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EUROPEAN SEARCH REPORT

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EP 97 10 1045

| DOCUMENTS CONSIDERED TO BE RELEVANT | | | |
|--|--|---|--|
| Category | Citation of document with indication, where appropriate, of relevant passages | Relevant to claim | CLASSIFICATION OF THE APPLICATION (Int.Cl.6) |
| E | EP 0 837 291 A (DENSO CORP ; NIPPON SOKEN (JP)) 22 April 1998 * column 8, line 34 - column 13, line 8; figures 1-3 * * column 20, line 49 - column 23, line 58; figures 14-16 * * column 26, line 5 - column 29, line 47; figures 18,19 * | 1-3,6-8, 11,12 | F25B9/00 F25B41/06 |
| X | NAKASHIMA Y., LIJIMA H., UMEHARA M., MATSUOKA F.: "Reversible-flow-type linear expansion valves for heat pumps" ASHRAE TRANS. (US), vol. 91 (part 2b), 1985, pages 1555-1568, XP002092713 * page 1556, paragraph 2 - paragraph 5; figures 1-3 * | 7-10,12, 14 | |
| X | EP 0 279 622 A (SANDEN CORP) 24 August 1988 | 7 | |
| A | * column 2, line 25 - column 3, line 28; figures 3,4 * | 1,4,6 | TECHNICAL FIELDS SEARCHED (Int.Cl.6) |
| X | EP 0 171 240 A (ALSENZ RICHARD H) 12 February 1986 | 7 | F25B |
| A | * page 9, line 15 - page 12, line 28; figure 1 * | 8,14 | |
| A | DE 24 59 485 A (DANFOSS AS) 1 July 1976 * page 4, paragraph 3 - page 5, paragraph 3; figures * | 1,3,6,7 | |
| The present search report has been drawn up for all claims | | | |
| Place of search THE HAGUE | | Date of completion of the search 9 February 1999 | Examiner Van Dooren, M |
| CATEGORY OF CITED DOCUMENTS X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document | | | |

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ON EUROPEAN PATENT APPLICATION NO.**

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09-02-1999

| Patent document cited in search report | Publication date | Patent family member(s) | Publication date |
|---|---------------------|----------------------------|---------------------|
| EP 0837291 A | 22-04-1998 | JP 10089785 A | 10-04-1998 |
| | | JP 10115470 A | 06-05-1998 |
| | | JP 10288411 A | 27-10-1998 |
| EP 0279622 A | 24-08-1988 | KR 9612738 B | 24-09-1996 |
| | | US 4788828 A | 06-12-1988 |
| EP 0171240 A | 12-02-1986 | US 4651535 A | 24-03-1987 |
| | | AU 4558485 A | 13-02-1986 |
| | | CA 1272887 A | 21-08-1990 |
| | | DE 3587300 A | 03-06-1993 |
| | | DE 3587300 T | 11-11-1993 |
| | | JP 61046868 A | 07-03-1986 |
| | | US 5402652 A | 04-04-1995 |
| | | US 5392612 A | 28-02-1995 |
| | | US 4697431 A | 06-10-1987 |
| | | US 5035119 A | 30-07-1991 |
| | | US 4735060 A | 05-04-1988 |
| | | US 4686835 A | 18-08-1987 |
| DE 2459485 A | 01-07-1976 | DK 570275 A,B, | 17-06-1976 |
| | | GB 1534700 A | 06-12-1978 |
| | | JP 51086852 A | 29-07-1976 |
| | | US 4158437 A | 19-06-1979 |

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

